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Regional Mapping of Peatland Boundaries using Airborne Radiometric Data and Supervised Machine Learning

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Peatlands are recognized as important carbon sequestration centres. Through restoration projects of peatlands in which the water table is raised, they may become carbon neutral or possibly carbon negative. National restoration plans require a knowledge of peatland extent and spatial distribution across large geographic areas.

Recently the availability of large geo-spatial datasets has increased. These range from soil, quaternary, and geology maps to airborne geophysical and satellite remote sensing data. Combining such datasets may provide a means to spatially map peatland extents and boundaries traditionally mapped via in-situ measurements. However, such datasets, and the relationship between them, are often complex. Modern Machine Learning methods can play a role in combining and analysing such multi-variate data within the discipline of Digital Soil Mapping.

Current peatland maps are created using combination of optical satellite remote sensing and legacy soil/quaternary maps. Optical remote sensing cannot detect peatlands under landcover such as forest or grassland. Legacy maps are often created from sparse in-situ augur, borehole, or trial pit data. These types of measurements do not allow for accurate measurement of boundaries or intra-peat variation.

Modern airborne geophysical datasets offer a potential means to update national and local scale peatlands maps. Radiometrics, a geophysical method that measures radiation emitted from geological materials, is particularly suited to peatland studies. Peat is a mostly organic material and so is, generally, not a source of radiation. Peat is also very saturated and water acts to scatter the emitted gamma rays. These effects combined means that peatlands act as a blanket to any source of radiation from below and show as “low” radiometric signal in the landscape.

This study aims to use Airborne Radiometric data combined with modern machine learning classification techniques to examine the current spatial distribution a peatland database in the west of Ireland. The Quaternary Geology database currently maps peatland extent where peat thickness is greater than 1m at the surface and was created using traditional mapping techniques. The methodology shows that a direct measurement, such as radiometric data, analysed in a supervised machine learning framework, provides more accurate and justifiable estimates of peatland extent in this region.